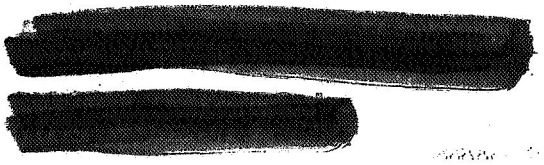
UTILIZATION OF NASA-GENERATED SPACE TECHNOLOGY BY MIDWESTERN INDUSTRY

QUARTERLY PROGRESS REPORT NO. 10
1 May 1964 - 31 July 1964

Task Order Contract No. NASr-63(03)

M.R.I. Project No. 2563-M



For

Technology Utilization Division
Office of Technology Utilization and Policy Planning
Code ATU
National Aeronautics and Space Administration
Washington, D. C. 20546

MRI
MIDWEST RESEARCH INSTITUTE

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by

E. C. Sneegas
C. R. Price

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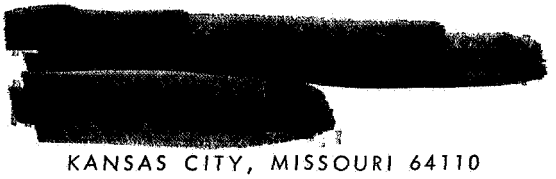

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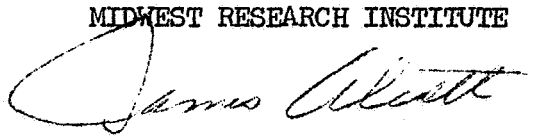
PREFACE

This Quarterly Progress Report covers project activity from 1 May 1964 through 31 July 1964. The report was prepared by Mr. E. C. Sneegas, Project Leader, and Mr. Charlton R. Price of the project staff.

Approved for:

MIDWEST RESEARCH INSTITUTE



James Alcott, Director
Economic Development Division

24 August 1964

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SUMMARY

Dissemination of technical information by mail continues to be an important part of the over-all program. Responses have been very good to ASTRA Innovation Announcements and an announcement of the availability of NASA SP-38, "Advanced Bearing Technology."

The ASTRA staff completed the writing and editing of a Technology Survey on the subject, "Advanced Valve Technology." This work has been delivered to NASA Headquarters for publication.

A detailed study was conducted to evaluate (1) what has been learned about the transfer process and its impact as a result of ASTRA efforts, (2) ASTRA resources and capabilities, and (3) recommended modifications and extensions of the ASTRA program. This study was the basis for discussions held with NASA Headquarters personnel, and provided the foundation for an MRI proposal for future work which has been submitted to NASA Headquarters.

I. INTRODUCTION

This is the tenth progress report on "Utilization of NASA-Generated Space Technology by Midwestern Industry." The period covered is 1 May 1964 - 31 July 1964.

Since November 1961, Midwest Research Institute has been conducting a pilot program for the NASA Office of Technology Utilization to develop effective ways of providing information about industrially useful space developments to manufacturers in seven Midwestern states. The assignment involves identifying useful space concepts, evaluating them for commercial utility, obtaining suitable documentation, and putting the ideas into forms useful to industrial management.

The task of dissemination of this information to industries began in March 1962, with a series of regional meetings to explain the program to industrial firms and to stimulate interest in the use of NASA technology. Following these meetings, MRI technical staff have visited several hundred different companies. We have also distributed much technical information by mail and have answered inquiries for specific information about the industrial potential of the space program.

Many of the major project activities during this quarter are continuing efforts as described in previous reports. This report will concentrate primarily upon those activities which are either new to the program or have received major emphasis during this quarter.

II. PROJECT STATUS

Project efforts during the report period have been directed to three objectives:

1. Preparation and dissemination of general and selective mailings to the approximately 900 firms on the ASTRA roster;

2. Production of book-length technology survey of developments in valve technology and other publications;

3. Continuing assessment of the effectiveness of various dissemination activities, as a basis for planning future work.

The review of ASTRA activities being carried on throughout the current year received special emphasis during the report period as a basis for discussions with a number of visitors from NASA Headquarters and for planning of future work. As a result of these discussions, a plan for future work has been submitted proposing a variety of new activities and several changes in emphasis in the program. Some of the proposed activities can be begun as part of the program for the current year.

III. PROJECT ACTIVITIES

A. General and Selective Mailings

A greatly increased flow of published information on new technical developments to companies in the ASTRA roster was achieved during the report period. These mailings include several different kinds of materials:

1. Tech Briefs and SP's from NASA; and

2. Innovation Announcements prepared by the project staff for selective mailing (i.e., to organizations identified through interest profiles as having a special interest in the type of technical information involved).

Most mailings consisted of several items. (See Appendix A for information.)

ASTRA MAILINGS
July 1964

Type of Item	No. of Items	General	Selective	Total No. of Mailings	Responses (Requests for Additional Information)
NASA Tech Briefs	66	22	-	22	24
NASA SP's	3	-	3	3	4
ASTRA Innovation Announcements	9	-	3	3	200
Announcement of Tech. Survey on Bearings	1	1	-	1	166
SBA Article on NASA R & D in Relation to Small Business	1	1	1	1	-
Total	80	23	7	30	394

In addition to these mailings, sizeable quantities of several NASA documents were forwarded to Northern Natural Gas Company, Omaha, for dissemination in their own extensive industrial development program.

NORTHERN NATURAL GAS DISTRIBUTION

NASA SP 5001	"Improved Precision Height Gage."	2,200 Copies
Tech Brief 63-10004	"Reference Black Body is Compact, Convenient to Use."	175 Copies
Tech Brief 63-10529	"Connector for Thermocouple Lead Saves Costly Wire, Makes Reliable Connectors."	175 Copies

The Northern Natural Gas Company request for 2,100 copies of Tech Brief No. 63-10006, "Setting of Angles on Machine Tools Speeded by Magnetic Protractor," was referred to NASA Headquarters.

The availability of NASA SP 38, "Advanced Bearing Technology," was announced to our industrial audience approximately two months after the book was published. This announcement, shown in Appendix C, brought an unprecedented 166 requests for copies of the book. These requests were mainly from the larger, more sophisticated companies in our region who were unaware that the book was available to them.

The brief Innovation Announcements, which include a form which can be returned if more information is desired, produced an encouraging response. We believe this response tends to confirm the experience gained in previous direct mail efforts, reemphasizing the importance of precision in selecting addressees, taking into account where possible not only the type of firm but specific persons within the firm who are responsible for various areas of technical interest. The selective mailing of brief announcements of technical developments, providing a convenient way for the addressee to request more information if wanted, is a desirable procedure from several points of view:

1. It provides a means for frequent contact with the widest possible industrial audience at minimum cost.

2. The pattern of requests for additional information can be studied to provide more precise knowledge of types of technical interests existing in individual firms and in various types of firms.

3. The expression of interest by the individual firm or organization member offers an additional entree for closer contact with the project, which can be followed up in a variety of ways: personal correspondence to identify related areas of technical interest, special searches of available data to meet particular needs expressed by several respondents, etc.

Thus, mailings are now being used by the project as a device for collecting information about the industrial audience, as well as disseminating information to it. As with other types of dissemination activity, this approach follows the "principle of successive approximation" discussed in the previous quarterly report.

The long-range objective is to establish a channel for continuing contact in which information can flow in both directions:

1. From the firm to the project staff, more detailed information on needs and interests, providing a basis for more sophisticated user-oriented service; and

2. From the project to the firm, increasingly salient and timely technical information, hopefully leading in some cases to a close enough contact between the project and the firm so that problems in the actual application of new technical knowledge within the organization can be identified and solved.

Project experience indicates that person-to-person contact within the individual firm is necessary in most instances for effective transfer and application of new technical knowledge.

B. Publications

1. Survey of Valve Technology

A book-length review of recent advances in valve technology, one of the Technology Survey series, was prepared during this report period. Work accomplished included site visits to seven NASA centers and one NASA contractor; review of relevant literature; writing, editing and revision of the rough draft to incorporate changes and corrections suggested by NASA scientists and engineers who had been interviewed earlier in assembling the data for the survey. The revised draft has been submitted to NASA Headquarters for final approval.

The information gathering phase of this activity was accomplished in a five-week period in May and June. The writing and editing was done in a six-week period in June and July. To meet the July 31 completion date, it was necessary to ask the NASA centers to review and correct their portions of the work in an extremely short time period of a few days. We received excellent cooperation from the personnel at the NASA centers in carrying out this difficult assignment.

Highly favorable comments on the survey have been received from NASA center personnel, industrial people and project consultants who reviewed the first draft. A senior staff member at one of the NASA centers visited in preparing the book said he was "astounded" that such a worthwhile result had been produced in so short a time, adding that he wanted to assure us of full cooperation on whatever additional surveys we might be preparing in the future. The president of a large, technically oriented company who saw an advance copy told the project staff that the survey was "an important study, and one that I think will be of real value to our technical people."

The work of preparing the survey was facilitated by existing experience in NASA centers and familiarity with industrial interests in this technical area gained as a result of earlier project activities. Despite limited advance notice and without detailed briefing on the purpose of our visits, people in the NASA centers were uniformly helpful, both in providing the original information and reviewing our editorial treatment of it in the first draft of the book.

A number of people in the centers told us that participating in preparation of the book had stimulated them to be more aware of utilization possibilities in the technical developments they were carrying out, and that the flow of information to the technology utilization office at the center had increased as a result.

We would like to offer the following suggestions for future activity of this kind:

a. Sufficient time and funds should be budgeted to permit careful planning and preparation for visits to centers and to contractors by those producing the book. Direct contact between those carrying out technical development and people with an awareness of needs and application possibilities in industry greatly increases the likelihood of uncovering information interesting and useful to industry.

We recognize two kinds of problems involved in such visits, but our experience indicates that both can be minimized by adequate advance preparation. One is the danger of unduly interrupting the regular work of NASA center personnel. However, we believe that adequate advance notice, plus the fact that only a few people at selected centers need be visited for a survey of any particular technical area, will minimize this potential difficulty.

A second possible problem pertains more directly to NASA contractors. Technical people in these organizations might be understandably reluctant to reveal potentially proprietary information which might represent a competitive advantage. Here, too, we have found that adequate advance preparation plus first-hand contact can make such visits productive. The value of the information available from contractors justifies the effort to obtain it, including taking time to assure those visited that the information they are supplying will be handled in a way which will not adversely affect the interests of the firm involved.

b. It may be desirable to develop a somewhat standardized format or outline for Technology Surveys: the general sequence of topics, kinds of information most needed, specification of what audiences or audience a given survey is intended to reach, etc. Existence of such a general organizational scheme would make more efficient both the collection of information and its processing into publishable form.

c. Some polling of the potential audience for each Technology Survey should be one of the preliminary steps taken on each of these reports. Members of this audience might include scientists and engineers with experience both with industry and with the technical field to be surveyed, representatives of companies manufacturing components which involve the specified technical area, and manufacturers of end-products which are affected by technical developments in the field concerned. Each group can be asked: What areas, problems or topics in this technical area would be of greatest interest to you? What kinds of information would you hope a survey on this topic would include? and similar questions. Advance questioning of the potential readers in this way would improve the ability of the editors to prepare material suited to the industrial audience, and would also serve to stimulate wider interest in the completed survey.

2. Other Publications

Innovation Announcements on 19 different subjects were prepared by the project staff during the report period. Nine of these were mailed to selected firms; the rest are now being printed and distributed. (See Appendix B for copies of the Innovation Announcements sent and the schedule of mailings.)

An ASTRA monograph on "Fused Amorphous Silica," has been prepared to send to selected firms on the ASTRA list. It is now being printed and will be mailed during September.

C. Other Project Activities

1. Miscellaneous Information Services

During the report period, the project processed 21 requests for information on individual patents, five requests for additional information on Tech Brief's previously mailed, and 57 requests for various individual publications.

A potentially major transfer opportunity developed with a Kansas City electronics equipment manufacturer, where we were able to supply a number of specific items of information helpful in solving a specific problem in vacuum tubes for use in microwave relay stations. Excerpts from the report of work with this company follow:

> "A senior engineer at the company in Kansas City, visited Project ASTRA on June 23 to obtain information relating to the fabrication of a vacuum tube product that is of immediate interest to him. The vacuum tube in question is used in the electronic equipment associated with their microwave repeater stations all over the country. The tube has a rated output of 1/2 w. The factor which limits the output of this tube is the structural integrity of the glass enclosure. Mr._____ conceived the concept of using a higher strength ceramic enclosure for this tube. He fabricated four sample tubes using alumina. This substitution of materials produced a 1-w. output, and the tube was successfully tested at a 2-w. output level. If this change of materials can be successfully achieved on a production basis, it will save the company $69,000 per year in tube material costs, and will double the capacity of the microwave system. In the beginning of this development, he was told by his company's research department that they had tried this same modification in 1959, but that their work was unsuccessful, and it couldn't be done. When he successfully produced four tubes in four tries, he got an audience at the research laboratory, and they are now pushing him to get this tube in production.
>
> "Mr._____ said he had a vague recollection that MRI had some sort of a project with NASA, and that we had visited his company about two years ago (this company visit was made by Eldon Sneegas and Jim Houston on July 3, 1962).

"Mr._____ presented three problem areas: (1) the selection of the proper ceramic material, (2) the fabrication of a ceramic-to-metal seal, and (3) a technique for electron beam welding the base of the tube. He stated he was sure we could not help him on the first two problems, but that he had heard we may be able to provide some information on electron beam welding.

"However, we were able to supply him with a massive file of information on all three of his problem areas.

"In the selection of the proper ceramic, the leading contender was alumina. We agreed at the beginning that beryllia would be a better material for his purpose. I supplied him with complete engineering details on the physical and electrical properties of beryllia and commercial sources of supply. Mr._____ said he had rejected beryllia because of the toxicity problems associated with its use. I provided him with two detailed studies of beryllia toxicity, showing that this problem has been magnified out of all proportion, and that with the simplest of housekeeping procedures, the material can be safely handled and used.

"On the subject of ceramic-to-metal seals, we found two papers dealing in detail with the exact problem he faces. In addition, I have requested on his behalf a computer-search in NASA's Office of Scientific and Technical Information for all NASA bibliography material on the subject of ceramic or glass-to-metal seals.

"On the subject of electron beam welding, we agreed that he has an ideal application for this remarkable fabrication tool. I provided him with several detailed technical articles on the use of electron beam welding equipment, the name and adresses of the companies manufacturing this equipment, and a list of companies that own electron beam facilities and will do job-shop work."

Mr._____ told us later that the information we had provided on alloys had probably saved two to four months of R&D time in carrying the improved tube to the production stage.

This account again underlines several principles of technology transfer already evident from earlier project experience:

a. The frequently extended time which elapses between first contact and an opportunity for application;

b. The need for an R&D or production requirement to exist before active efforts are made by a firm to incorporate new information;

c. The necessity of a user-oriented point of view in searching for relevant technological data and processing the information obtained.

2. Group Presentations and Conferences

Two presentations of ASTRA resources and services were made during the report period. On May 19, Eldon Sneegas, John Loser and Glenn Seay met with 75 members of the engineering staff at Sunray-DX Oil Company in Tulsa, Oklahoma. Eldon Sneegas addressed an audience of 250 at Durant, Oklahoma, on May 21 as part of the industry meeting for the Technology Use Studies Center. He also attended the New Technology Conference at Lewis Research Center on June 4 and 5, where ASTRA exhibits were a feature of the program.

3. Subscription to Computer-Tape Services from Marshall Space Flight Center

During this report period, we requested two computer-tape literature searches by NASA's Analysis and Research Unit, Scientific and Technical Information Division. These bibliographic searches were performed promptly, and the information was relayed to the companies requesting the search.

For a Kansas City agricultural equipment manufacturing company, a bibliographic search was run on the subject, "Buckling of Thin Cylindrical Shells." This search yielded over 100 references. This information is being evaluated by the company engineers. Their immediate comment was that the information is "quite comprehensive" and looks promising.

For a Kansas City electronics manufacturing company, a bibliographic search was run on the subject, "Ceramic to Metal Seals." This search yielded 66 references. After receiving this bibliography, the company reported: "We found two of the references in our own library. The data in these two articles will save two to four months time in getting the right alloy. We are ordering nine of the remaining citations."

On July 15, 1964, we formally requested that Project ASTRA be given access to the computer-tape facility located at the Marshall Space Flight Center, Huntsville, Alabama. The purpose of this request is to broaden the input to Project ASTRA to include machine-tape searches of title listings, both from NASA and the unclassified documents from the Army Redstone facility. We anticipate we will be requesting narrowly defined subject searches at a rate that will not overload this facility.

4. Visitors

Four visitors from NASA Headquarters during the report period were briefed in detail on current project activities and future plans. Breene Kerr, newly appointed Deputy Assistant Administrator for Technology Utilization, visited the project on July 1. Other visitors were James Dennison (July 9 and 10), Noel Sargent (June 3) and Jerome Teplitz (July 1).

Robert Dillon, of the Technology Use Studies Center, Durant, Oklahoma, visited the project on July 14. We provided him with 42 slides from project files for use in presentations to southeast Oklahoma industrial audiences.

IV. PLANS FOR FUTURE WORK

During the current quarter, we expect to maintain the augmented schedule of general and selective mailing to firms on the project roster. Visits to individual firms for intensive work within these organizations on problems of application will be resumed. In addition, we plan to begin some of the activities proposed in the plans for future project work now being reviewed by NASA Headquarters.

During the current quarter, we will also conduct a second mail survey of participating firms to assist us in assessing the impact of project activities to date and gauging the amount and kind of future participation to be expected by various sizes and types of participating firms. We will make a special effort to identify those firms which have benefited from project participation sufficiently to consider subscribing to the project on a fee-for-service basis.

APPENDIX A

ASTRA MAILINGS - MAY, JUNE, JULY 1964

ASTRA INDUSTRY MAILINGS - MAY, JUNE, JULY, 1964

Mailing No.	Date	Title	Mailing List	Number	Response
20	May 3	NASA Tech Brief Nos.:	General	922	
		63-10250 - "Level of Super-Cold Liquids Automatically Maintained by Levelometer."			
		63-10258 - "Double-Throw Microwave Device Switches Two Lines Quickly."			2
		64-10002 - "Circuit Reliability Boosted by Soldering Pins of Disconnect Plugs to Sockets."			
21	May 7	NASA Tech Brief Nos.:	General	920	
		63-10235 - "Cryogenic Filter Method Produces Super-Pure Helium and Helium Isotopes."			
		63-10318 - "Quick-Hardening Problems are Eliminated With Spray Gun Modification Which Mixes Resin and Accelerator Liquids During Application."			1
		63-10502 - "Fluid-Pressure Meter can be Calibrated Without Removal from Flow Line."			1
22	May 11	NASA Tech Brief Nos.:	General	920	
		63-10236 - "Lightweight Universal Joint Transmits Both Torque and Thrust."			
		63-10346 - "New Method Used to Fabricate Lightweight Heat Exchanger for Rocket Motor."			
		63-10557 - "Rapid Helium-Air Analyzer Can Measure Other Binary Gas Mixtures."			2

Mailing No.	Date	Title	Mailing List	Number	Response
23	May 13	Offer of copies of "Advanced Bearing Technology."	General	919	166
24	May 15	NASA Tech Brief Nos.:	General	919	
		63-10008 - "Vacuum Forming of Thermoplastic Sheet Results in Low-Cost Investment Casting Patterns."			2
		63-10291 - "Special Pliers Connect Hose Containing Liquid Under Pressure."			
		64-10001 - "New Inflatable Liferaft is Non-tippable."			1
25	May 18	NASA Tech Brief Nos.:	General	919	
		63-10420 - "Simple Mechanism Combines Positive Locking and Quick-Release Features."			
		63-10536 - "Hot-Air Soldering Technique Prevents Overheating of Electrical Components."			
		63-10571 - "Self-Balancing Beam Permits Safe, Easy Load Handling Under Overhang."			
26	May 21	NASA Tech Brief Nos.:	General	919	
		63-10003 - "New Low-Level A-C Amplifier Provides Adjustable Noise Cancellation and Automatic Temperature Compensation."			
		63-10193 - "Removable Preheater Elements Improve Oxide Induction Furnace."			
		63-10255 - "Transfluxor Circuit Amplifies Sensing Current for Computer Memories."			

Mailing No.	Date	Title	Mailing List	Number	Response
27	May 25	NASA Tech Brief Nos.: 63-10023 - "V-Slotted Screw Head and Matching Driving Tool Facilitate Insertion and Removal of Screw Fasteners." 63-10292 - "Heavy-Duty Staple Remover Operated by Hand." 63-10435 - "Portable Display Paneling Has Wide Use, Easy Take Down and Assembly."	General	919	1
28	May 27	NASA SP-5004 - "Space Batteries."	Selective	482	3
29	May 28	NASA Tech Brief Nos.: 63-10234 - "Filter for High-Pressure Gases has Easy Take Down, Assembly." 63-10526 - "Built-In Templates Speed Up Process for Making Accurate Models." 63-10537 - "Simple Circuit Provides Adjustable Voltage with Linear Temperature Variation."	General	919	
30	May 29	NASA SP-5006 - "The Measurement of Blood Pressure in the Human Body."	Selective	352	
31	June 2	NASA Tech Brief Nos.: 63-10027 - "Increased Performance Reliability Obtained with Dual (Redundant) Oscillator System." 63-10304 - "Break-Up of Metal Tube Makes One-Time Shock Absorber, Bars Rebound." 63-10351 - "New Cobalt Alloys have High-Temperature Strength and Long Life in Vacuum Environments."	General	918	

Mailing No.	Date	Title	Mailing List	Number	Response
32	June 3	NASA SP-5007- "Measurement of the Heartbeat of Bird Embryos with a Micrometeorite Transducer."	Selective	415	1
33	June 5	ASTRA Innovation No. 88 - "Ceramic Insulation." ASTRA Innovation No. 89 - "Reflective Ceramic Insulation." ASTRA Innovation No. 90 - "Refractory Thermal Insulation."	Selective	474	29 31 28
34	June 11	NASA Tech Brief Nos.: 63-10227 - "Electromechanically Operated Camera Shutter Provides Uniform Exposure." 63-10240 - "Sleeve and Cutter Simplify Disconnecting Welded Joint in Tubing." 63-10247 - "New Package for Belleville Spring Permits Rate Change, Easy Disassembly."	General	911	
35	June 15	NASA Tech Brief Nos.: 63-10198 - "Device Transmits Rotary Motion Through Hermetically Sealed Wall." 63-10354 - "Rapid Billet Loader Aids Extrusion of Refractory Metals." 63-10517 - "Miniature Oxygen-Hydrogen Cutting Torch Constructed from Hypodermic Needle."	General	914	
36	June 18	NASA Tech Brief Nos.: 63-10004 - "Reference Black Body is Compact, Convenient to Use."	General	914	175 NoNatGas

Mailing No.	Date	Title	Mailing List	Number	Response
36	June 18	NASA Tech Brief Nos.: 63-10009 - "Chain Friction System Gives Positive, Reversible Drive." 63-10529 - "Connector for Thermocouple Lead Saves Costly Wire, Makes Reliable Connectors."	General	914	2+ 175 NoNatGas
37	June 23	NASA Tech Brief Nos.: 63-10241 - "Veitch Diagram Plotter Simplifies Boolean Functions." 63-10481 - "Refractory Ceramic Has Wide Usage, Low Fabrication Cost." 63-10489 - "Fine Particle Filter Prevents Damage to Vacuum Pumps."	General	914	8
38	June 26	NASA Tech Brief Nos.: 63-10033 - "Indium Foil with Beryllia Washer Improves Transistor Heat Dissipation." 63-10264 - "Novel Horn Antenna Reduces Side Lobes, Improves Radiation Pattern." 63-10385 - "Flexible Honeycomb Structure Can Bend to Fit Compound Curves."	General	914	1
39	June 29	NASA Tech Brief Nos.: 63-10207 - "Thermally Conductive Metal Wool-Silicone Rubber Material Can be Used as Shock and Vibration Damper." 63-10311 - "Oil-Smeared Models Aid Wind Tunnel Measurements." 63-10431 - "High-Temperature, High-Pressure Spherical Segment Valve Provides Quick Opening."	General	914	1

Mailing No.	Date	Title	Mailing List	Number	Response
40	June 28	ASTRA Innovation No. 91 - "Electromagnetic Flowmeter for Low Conductivity Fluids."	Selective	408	31
		ASTRA Innovation No. 92 - "A Sensitive Method for 'Ground Loop' Detection."			26
		ASTRA Innovation No. 93 - "Vibrating Membrane Electrometer."			13
41	July 2	NASA Tech Brief Nos.:	General	913	
		63-10006 - "Setting of Angles on Machine Tools Speeded by Magnetic Protractor."			1
		63-10606 - "New Sintering Process Adjusts Magnetic Value of Ferite Cores."			
		64-10021 - "Pressure Transducer 3/8-in. in Size Can be Faired Into Surface."			
42	July 6	NASA Tech Brief Nos.:	General	910	
		63-10174 - "Modular Chassis Simplifies Packaging and Interconnecting of Circuit Boards."			
		63-10280 - "Meter Accurately Measures Flow of Low-Conductivity Fluids."			
		63-10321 - "Improved Variable-Reluctance Transducer Measure Transient Pressures."			
43	July 9	NASA Tech Brief Nos.:	General	910	
		63-10238 - "Shaped Superconductor Cylinder Retains Intense Magnetic Field."			
		64-10015 - "Comfortable, Lightweight Safety Helmet Holds Radio Transmitter, Receiver."			
		64-10010 - "Modified RF Coaxial Connector Ends Vacuum Chamber Wiring Problem."			

Mailing No.	Date	Title	Mailing List	Number	Response
44	July 13	NASA Tech Brief Nos.:	General	910	
		63-10091 - "Modified Filter Prevents Conduction of Microwave Signals Along High-Voltage Power Supply Leads."			
		63-10284 - "Small Digital Recording Head has Parallel Bit Channels, Minimizes Cross Talk."			
		64-10011 - "Metal Strip Forms 21 Foot Boom, Rolls, Up for Compact Storage."			1
45	July 7	ASTRA Innovation No. 94 - "Frequency Stabilization of an Astable Multivibrator for Temperature Variation."	Selective	418	14
		ASTRA Innovation No. 95 - "Tunnel Diode Monostable Multivibrator."			14
		ASTRA Innovation No. 96 - "Brushless DC Motor and Starting and Driving Electronics."			14
46	July 20	NASA Tech Brief Nos.:	General	909	
		63-10508 - "Circuit Switches Latching Relay in Response to Signals of Different Polarity."			
		63-10599 - "Liquid Switch is Remotely Operated by Low DC Voltage."			
		64-10065 - "Continuity Tester Screens Out Faulty Socket Connections."			
47	July 23	SBA Management Aid No. 159 "How NASA's R&D Helps Small Business."	General	909	

Mailing No.	Date	Title	Mailing List	Number	Response
48	July 27	NASA Tech Brief Nos.: 63-10260 - "Solar-Angle Sensor Has No Moving Parts." 63-10365 - "Low-Cost Insulation System for Cryostats Eliminates Need for a Vacuum." 63-10424 - "Variable Light Source with a Million-To-One Intensity Ratio."	General	908	
49	July 30	NASA Tech Brief Nos.: 63-10200 - "Apparatus of Small Size Can be Extended Into Long, Rigid Boom." 63-10367 - "Connector for Vacuum-Jacketed Lines Cuts Tubing System Cost." 63-10442 - "Kinetic-Energy Absorber Employs Frictional Force Between Mating Cylinders."	General	908	

APPENDIX B

ASTRA INNOVATION ANNOUNCEMENTS - MAY, JUNE, JULY, 1964

ASTRA INNOVATION ANNOUNCEMENTS WRITTEN DURING THE REPORT PERIOD 1 MAY - 31 JULY, 1964

No.	Title
87	Inductive Displacement Sensor
88	Ceramic Insulation
89	Reflective Ceramic Insulation
90	Refractory Thermal Insulation
91	Electromagnetic Flowmeter for Low Conducting Fluids
92	A Sensitive Method for "Ground Loop" Detection
93	Vibrating Membrane Electrometer
94	Frequency Stabilization of an Astable Multivibrator
95	Tunnel Diode Monostable Multivibrator
96	Brushless DC Motor and Starting and Driving Electronics
97	A Simple, Fast Response Anemometer
98	Distance Indicator and Transducer
99	Vibrating Electric Arc for Metal Surface Roughening
100	An Isothermal Calorimeter for Determining Vapor Quality
101	Automatic Temperature Regulator for Circulating Fluid Systems
102	Regulating Valve for Flexible Tubing
103	Thermocouple Continuity Monitor
104	A Method for Producing Reflective Elements
105	Resistance Heated Radiant Heat Source
106	An Instrument for Accurate Determination of Squareness or Perpendicularity

MIDWEST RESEARCH INSTITUTE

ASTRA INNOVATION NO. 87

Title: Inductive Displacement Sensor.

Abstract: The inductive pickup of this device responds to the time-varying distance between the end of a sinusoidally energized coil and a conductive surface. The device is ideally suited for instrumentation in vibration studies of panels or structural members.

4-21-64

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No. 87

For further information about this innovation, mail coupon to:

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MIDWEST RESEARCH INSTITUTE

ASTRA INNOVATION NO. 88

Title: Ceramic Insulation

Abstract: This foamed ceramic composition, developed at NASA's Goddard Space Flight Center, is based on aluminum phosphate, is lightweight and has good insulating properties. The material is solidified more easily than other foamed ceramics at an unusually low curing temperature, as low as 150°F. Density is controllable over a range from 140 lb/cu ft to 19 lb/cu ft. The material can be made in different colors and has excellent thermal shock resistance.

5-8-64

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MIDWEST RESEARCH INSTITUTE

ASTRA INNOVATION NO. 89

Title: Reflective Ceramic Insulation

Abstract: This new material, developed at NASA's Marshall Space Flight Center, is a composite, reflective insulation material prepared from fibrous potassium titanate, asbestos fibers, and colloidal silica. The insulation maintains its structural integrity up to 2200°F, is nonflammable, easily applied and can be air cured.

While presently used as an insulator for protecting airframes against radiant heat, the excellent thermal shock resistance, relatively easy application on welded expanded metal grids, and good moisture resistance should suggest diversified uses in thermal protection.

5-8-64

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MIDWEST RESEARCH INSTITUTE

ASTRA INNOVATION NO. 90

Title: Refractory Thermal Insulation

Abstract: This material is a trowelable refractory insulation with good metal adherent properties. Shear loads of 5 psi mortar to metal surface can be borne up to 700°F interface temperature. This insulation was designed to protect rocket aft end metal surfaces from engine exhaust heat. It has high optical reflectance and is air cured at room temperatures.

5-8-64

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MIDWEST RESEARCH INSTITUTE

ASTRA INNOVATION NO. 91

Title: Electromagnetic Flowmeter for Low Conductivity Fluids

Abstract: Accurate average rate-of-flow measurements of low electrical conductivity fluids (such as water) can be obtained with this device.

Although the principle employed (electromagnetic or Faraday effect) is not novel, the simplicity of the design and operation is noteworthy.

The flow sensitivity (approximately 0.05 mv/cm/sec) is virtually independent of the fluid conductivity over a range of 0.2 to 5×10^{-8} mho/cm. Furthermore, since no physical contact is made with the fluid, the flow characteristics are not altered.

5-13-64

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MIDWEST RESEARCH INSTITUTE

ASTRA INNOVATION NO. 92

Title: A Sensitive Method for "Ground Loop" Detection

Abstract: In electronic circuits and/or systems, it is always desirable and oftentimes imperative to detect and eliminate "ground loops."

A method for detecting potential differences due to current flowing in "ground loops" is described in this recent NASA disclosure. The technique is simple, and easy to implement. The only equipment required of the potential user is an oscilloscope having a high sensitivity differential amplifier and a specially altered two-conductor shielded cable.

5-13-64

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MIDWEST RESEARCH INSTITUTE

ASTRA INNOVATION NO. 93

Title: Vibrating Membrane Electrometer

Abstract: This electrometer device, which employs a combination of mechanical and dynamic capacitance principles, is capable of conversion gains of 2×10^3 in voltage and 2×10^{12} in current. The instrument also exhibits the following desirable features:

1. Low internal power consumption
2. Rugged
3. Compact

Its performance characteristics indicate considerable promise for instrumentation and laboratory applications which require high sensitivity.

5-13-64

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MIDWEST RESEARCH INSTITUTE

ASTRA INNOVATION NO. 94

Title: Frequency Stabilization of an Astable Multivibrator for Temperature Variation

Abstract: Temperature sensitive zener diodes and a resistor network provide a temperature sensitive voltage source. This, in turn, provides frequency stabilization of a conventional two-transistor astable multivibrator. Experimental results show that the frequency varied only 0.15% over the temperature range of 0°C to +40°C.

Since frequency stability under varying temperature conditions is often significant to the circuit design engineer, this technique appears to have considerable merit in timing circuits.

- -

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MIDWEST RESEARCH INSTITUTE

ASTRA INNOVATION NO. 95

Title: Tunnel Diode Monostable Multivibrator

Abstract: The high and low voltage stable states of a tunnel diode are utilized to improve the circuit performance characteristics of a monostable multivibrator. A semi-detailed discussion of the circuit operation is given in the text of the related NASA disclosure.

Three outstanding features are:

1. Rise and fall times of less than 0.2 microsecond.
2. A 95% duty cycle can be obtained with this circuit.
3. The fall time is totally independent of the duration of the quasi-stable state.

These combined features might be of particular interest to the design engineer who is concerned with pulse and timing circuits.

- -

No. 95

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MIDWEST RESEARCH INSTITUTE

ASTRA INNOVATION NO. 96

Title: Brushless DC Motor and Starting and Driving Electronics

Abstract: This brushless DC motor and its associated semiconductor electronic circuitry was designed, developed and operated at NASA's Goddard Space Flight Center. The primary use by NASA was for spacecraft tape recorder drive systems.

Perhaps the most salient feature of the design is the provision for self-starting and automatic restart from stall by use of a "tone" wheel and an inductive pickup.

The running operation (shaft rotation) is achieved by an oscillator driving an SCR ring counter which sequentially switches through an even number of wound stator poles in conjunction with an odd number of permanent magnet rotor poles.

The design appears to be very appropriate for applications where elimination of brush wear and minimization of mechanical and electrical noise are desirable.

June 2, 1964

- -

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APPENDIX C

ADVANCED BEARING TECHNOLOGY ANNOUNCEMENT

MIDWEST RESEARCH INSTITUTE

ADVANCED BEARING TECHNOLOGY

NASA has just published the first of a continuing series of state-of-the-art summaries on subjects of interest to industry. This 511-page book, "Advanced Bearing Technology," was written by Edmond E. Bisson and William J. Anderson, both scientists at NASA's Lewis Research Center, Cleveland, Ohio.

We believe this book represents a significant achievement and will be a valuable resource to those concerned with bearings and lubrication. For your information we have reproduced the title page, preface and table of contents.

For a complimentary* copy of the book, mail the coupon below to

Mr. Eldon Sneegas
Project ASTRA
Midwest Research Institute
425 Volker Boulevard
Kansas City, Missouri 64110

* Since the book represents a larger than average investment for Project ASTRA, we ask your cooperation in restricting your requests to those involving a bona-fide industry interest.

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ADVANCED BEARING TECHNOLOGY

By
EDMOND E. BISSON
AND
WILLIAM J. ANDERSON
Lewis Research Center, Cleveland, Ohio

Office of Scientific and Technical Information 1964
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
Washington, D.C.

PREFACE

THIS BOOK is an outgrowth of a set of lecture notes originally published for an advanced course on bearing technology at the University of California at Los Angeles. Its objectives are twofold:

(1) To present an exposition of the fundamentals of (a) friction and wear, (b) fluid film bearings, and (c) rolling-element bearings

(2) To demonstrate, through discussion of selected research results, how fundamental principles can be applied to the solution of unique and advanced bearing problems involving environmental factors such as extreme temperature, radiation, high vacuum, and corrosive fluids

The book is devoted primarily, in the examples and the discussion of research results, to advanced bearing problems; for example, the current and anticipated bearing problems in aircraft, in missiles, and in spacecraft are covered in some detail. The principles established and enunciated herein are, however, not limited in their application to advanced bearing problems. On the contrary, these principles apply equally well to mundane and ordinary bearing problems.

Many of the research investigations described herein were a part of the exploratory research program being conducted at the laboratories of the NASA Lewis Research Center by the authors and their colleagues. This research program was designed to explore the fundamentals in advanced problem areas and to establish basic principles, where possible, in these advanced areas. Application of these basic principles is possible not only within the advanced areas but under ordinary conditions as well.

The two chapters of this book that were written by guest authors are natural outgrowths of the lectures that they originally gave as part of the advanced course on bearing technology.

The authors are indebted to the members of the Lubrication and Wear and Editorial Branches of the Lewis Research Center for their assistance in reviewing and editing the manuscript. In particular, the assistance of Robert L. Johnson in technical matters and Margaret C. Appleby in editorial matters is appreciated.

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